

# C4I for the Warrior

*"The Joint Vision for C4I Interoperability"*



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## *C4I for the Warrior: A Vision for Joint C4I Interoperability*



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**C4I for the Warrior: “a unifying concept that brings to the warrior an accurate and complete picture of the battle space, timely and detailed mission objectives, and the clearest view of their targets.”**



**Figure 1: The Interoperability Road Map**

## I. INTRODUCTION

*C4I for the Warrior* (C4IFTW) provides the philosophical underpinning for C4I systems. Started in 1992, *C4I for the Warrior* has provided a consistent vision, guiding the development of all DoD C4I systems. Its underlying theme is interoperability for all C4I systems. *C4I for the Warrior* is also our means of achieving Information Superiority and supporting Joint Vision 2010.

Our C4I experiences during Desert Shield and Desert Storm were the impetus behind the *C4I for the Warrior* vision. Desert Shield and Desert Storm were a wake up call that demanded we look anew at the acquisition and management of C4I systems. The desert conflict gave us a clear look at the future and we quickly realized the future was rooted in three undeniable facts:

- The defense budget would continue to decline.
- C4I technologies would continue to advance.
- Joint warfare was the future. We would never fight as a single Service and to fight joint we must be interoperable.

With the budget declining, technology advancing, and joint warfare in mind, the C4IFTW road map, Figure 1,

was defined with three measurable phases.

- Quick Fix Phase - fix the C4I problems discovered in the desert conflict

Mid Term Phase:

- Embed total interoperability in new C4I systems
- Produce Modular C4I Systems
- Construct a Global Wide Area Network

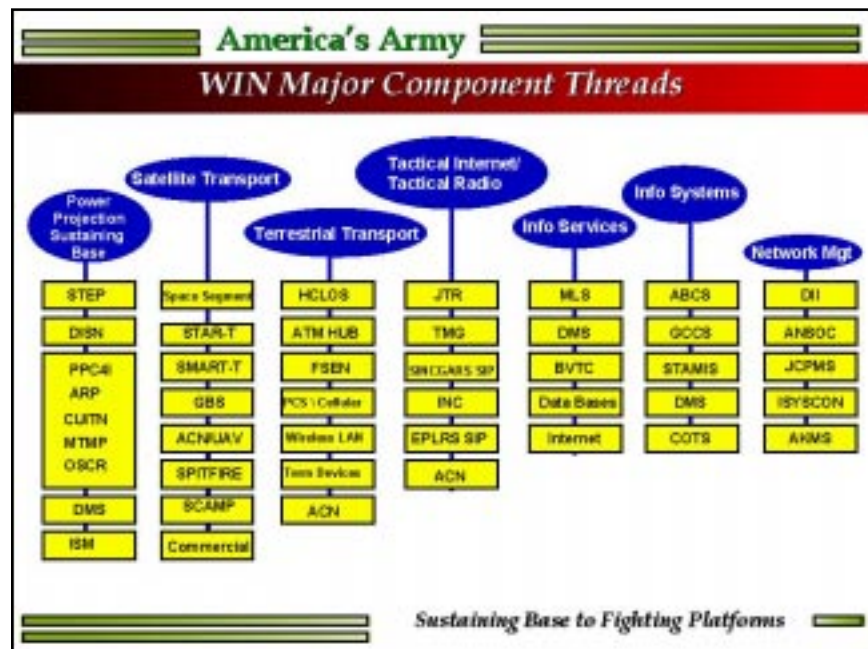
Objective Phase:

- Establish Information Superiority - in peace and conflict

With the Quick Fix Phase accomplished in 1993, we turned our sights to the Mid Term Phase goals and we set the new millennium as our completion date. Great progress was made in 1996 and 1997, and, because of the extraordinary efforts of the men and women on the joint, Service, agency, and CINC teams, we are close to accomplishing the mid-term goals. Though not completed, the progress is such that it cannot be easily dismissed. Much of this progress can be attributed to the focus provided by the Service's complementary visions.



Figure 2: The Army Warfighter Information Network



The Army's *Enterprise* Strategy supports digitization efforts and focuses on the information needs of the Army as a whole. At the heart of the Army's *Enterprise* Strategy are ten visionary principles:

- Focus on the Warfighter
- Capitalize on Space-Based Assets
- Modernize Power Projection Platforms
- Implement Multi-Level Security
- Acquire Integrated Systems Using Commercial Technology
- Ensure Joint Interoperability
- Digitize the Battlefield
- Exploit Modeling and Simulation
- Ensure Spectrum Supremacy
- Optimize the Information Technology Environment

The *Enterprise* Strategy is the synchronization of Army programs with the Joint Staff's C4I for the Warrior concept, sound business practices, and the Defense Information Infrastructure Master Plan.

The Warfighter Information Network (WIN) is the Army's architecture strategy that integrates standard, commercially based, and evolving high technology information and communications systems (see Figure 2). WIN is designed to increase the capacity and velocity of information distribution throughout the battlespace to gain information dominance. The WIN components are the Army's contribution to Network Centric Warfare. (Network Centric Warfare is discussed on page 20.)



Figure 3: *Copernicus*

**The Navy and Marine Corps *Copernicus*** vision takes on added significance in meeting the challenges of C4IFTW. This common vision enables the Navy and Marine Corps to adapt, evolve, and fully integrate their Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) capabilities and resources and conduct successful joint Naval Expeditionary Force operations. Navy and Marine Corps warriors fighting Forward...From The Sea will have the capabilities to achieve dominant maneuver, precision engagement, full dimensional protection, and focused logistics in any clime and place (see Figure 3).

## *C4I for the Warrior: A Vision for Joint C4I Interoperability*

**The Air Force** has fully embraced the concept of expanding the battlespace beyond the conventional view of land, sea, air, and space into the fifth dimension of the infosphere. *HORIZON* (see Figure 4) provides the vision leading the Air Force to fully integrated information operations as a full partner in all activities across the spectrum of conflict.

*HORIZON* describes how communications and information enable GLOBAL ENGAGEMENT – the Air Force’s long range plan for employing air and space power. In this C4IFTW update, the Air Force Near and Mid term activities that lead to the vision are shown as supporting the six Air Force core competencies described in GLOBAL ENGAGEMENT. To Air Force people executing global operations, C4IFTW means accurate,

relevant information, anytime, anywhere, and in the correct format.

The newly created Air and Space Command and Control Agency (ASC2A) brings the Air Force a significant step closer to realizing C4IFTW. ASC2A serves as the lead Air Force agency charged with pulling Air Force C2 together across the major commands. Its primary tasks are to integrate air and space C2, eliminate duplication of effort, and drive toward commonality.

To guide these tasks, the Air Force will build an air and space C2 modernization strategy, mission area plan, and investment plan that takes Air Force C2 into the 21<sup>st</sup> century.



Figure 4: Horizon

*The remainder of this C4I for the Warrior update concentrates on joint progress to date. It allows a comparison against the mid-term goals and includes the thoughts of the Services on supporting these mid-term goals. The Joint Staff and the Services trust you will find the information helpful!*





## II. MID-TERM PHASE GOAL #1

*EMBED TOTAL INTEROPERABILITY IN NEW C4I SYSTEMS.*

### DOCTRINE AND POLICY

Making joint policy and regulatory documents user-friendly and responsive made great progress. In the doctrine arena, the focus was the Joint Publication 6-0 series. These publications provide guidance and direction for formulating operational and tactical C4 policy. Rewriting and consolidating DoD regulations and the Chairman's interoperability instruction also began in 1996. These regulations and instructions will allow verification of interoperability via a requirements document review and through a structured test program.

The Services fully supported the concept of joint architectures to ensure full interoperability as they define their operational architectures. The Services' operational architectures link mission areas and functions to the Universal Joint Task List. When placed on the World Wide Web, these architectures will serve users and program managers. Users will gain a better understanding of the architectures and how they relate to joint mission areas, while ensuring proper identification of interfaces and connectivity.

### EDUCATION

Rapid changes continue challenging our ability to train and educate warriors. Because informed warriors are a potent influence in the fight for interoperability, efforts to educate DoD users and acquisition managers on the need for interoperability expanded. Formal schools with *C4I for the Warrior* on the curriculum increased significantly.

The Services continue streamlining training and educational systems to provide efficient, up-to-date, comprehensive training. Course consolidation, outsourcing, and interservice training contribute to cost-effective training, as does an aggressive use of simulation, virtual reality tools, war games, models, electronic classrooms, electronic training manuals and distance learning. As technologies impact the structure, content, and delivery of training, we remain committed to providing quality solutions to training challenges.

### ARCHITECTURES

DoD approved a C4ISR architecture framework of three architectures (Operational, Systems, and Technical) in 1996 (see Figure 5) and as the starting point for future work published the Joint Technical Architecture (JTA). The JTA and Technical Architecture Framework for Information Management now guide emerging C4I systems, Advanced Concept Technology Demonstrations (ACTD), and weapon systems C4I interfaces.

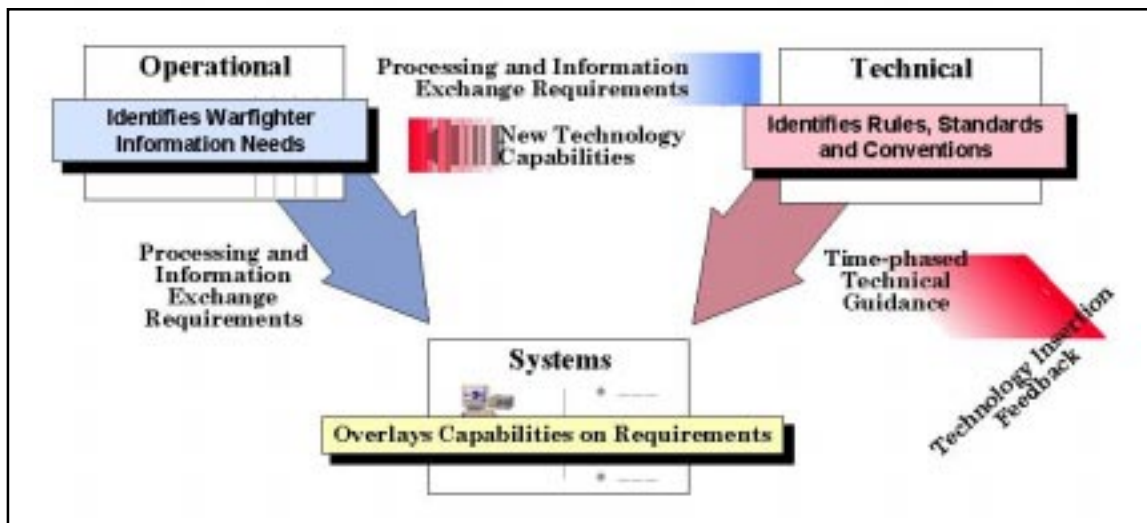


Figure 5: Integrated Architecture Framework

### INFORMATION SECURITY/ ASSURANCE

As our information systems become increasingly critical to the successful prosecution of joint operations, these same systems become increasingly vulnerable to attack. Growing dependence on information places us at increased risk if we do not consider information security and assurance. In addition to clear requirements for physical security of systems and their components, the joint community is fully aware of the importance of information security, system integrity, and survivability. Reliance on information systems is increasing; therefore, defense against information security threats must also be dynamic.

As information technology continues to proliferate and as our susceptibility to Information Operations (IO) increases, defensive information warfare will enable full spectrum protection. Such protection demands that joint forces be able to detect an attack and once detected, restore an information system's integrity. Joint Publication 3-13<sup>1</sup> and CJCSI 6510.1A<sup>2</sup> are tangible efforts which articulate our information protection policy.

Both publications are approaching final staffing and should be released for publication soon.

Effective responses to threats ranging from hackers to sophisticated computer experts are basic to mission accomplishment. Now, and even more so in the future, information is at risk from intrusion, deception, interception, corruption, or modification. Action across a broad front to train our operators is our first line of defense. Because the network is intolerant of weak links, protecting the network and information requires a robust, joint, mobile, defense in depth. INFOSEC, computer security, communications security, and multilevel security (MLS) must eventually be imbedded in architecture and included in doctrine.

<sup>1</sup> Joint Doctrine for Information Warfare

<sup>2</sup> Defensive Information Warfare Implementation



True MLS extending from compartmented to unclassified levels is not yet within our reach. However, we have made progress in MLS for information up to the 'secret' classification. MLS at these levels is now attainable. While additional safeguards protect higher classifications, secret and below information can populate a common terminal and move quickly from sender to recipient.

These ongoing security efforts will speed the movement of information, enhance interoperability, and conserve ever scarcer resources.

**The Services** are fully engaged in several specific information assurance initiatives that contribute substantially to the overall security of the Defense Information

Infrastructure (DII) and ensure functionality under duress. Systems' survivability will be achieved by:

- dispersing key facilities
- multiplicity of communications modes
- appropriate hardening
- network control centers
- computer emergency response support teams
- red teams
- training
- base, post, and station information protection measures
- information systems security programs

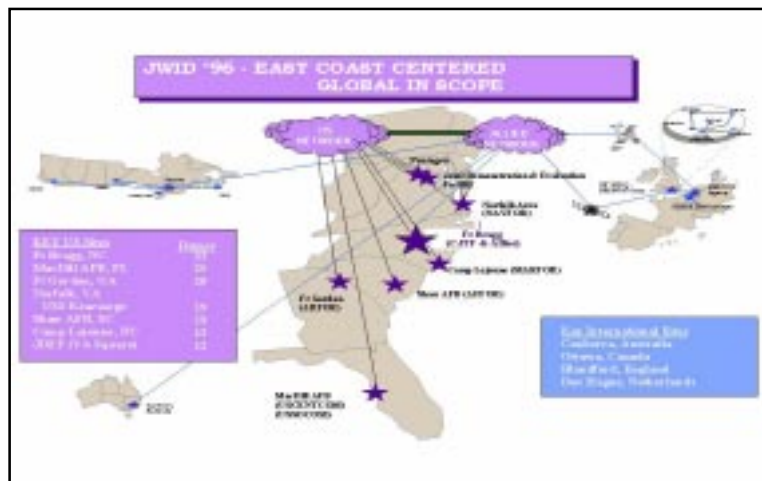


Figure 6: JWID 96

## JOINT WARRIOR INTEROPERABILITY DEMONSTRATIONS (JWID)

JWID identifies warfighter C4I interoperability requirements and issues, and provides the opportunity to evaluate solutions in a low risk environment. Sponsored by a different CINC and led by a different Service every other year, this rotating leadership provides multiple perspectives in terms of implementing interoperable C4I systems.

**The Army** led JWID 96 (Figure 6). With the Joint Staff as the overall sponsor and Central Command as the host combatant commander, JWID 96 emphasized command and control. JWID 96 continued to display technology advances, networking, and interoperability through a Joint Task Force (JTF) deployment. JWID 96 was designed to demonstrate interoperability among fielded and emerging C4I systems. Like its predecessors, JWID 96 provided an open experimental demonstration

arena assisting and accelerating positive improvement in C4I systems, their applications, and supporting networks.

**The Navy and Marine Corps** continue their support of JWID. JWID 97, led by the Navy, demonstrated technological solutions to joint command, control, communications, computers, and intelligence interoperability challenges within a deployed coalition task force environment (see Figure 7). This coalition task force included NATO and the Combined Communications-Electronics Board nations.

## C4I for the Warrior: A Vision for Joint C4I Interoperability

Demonstration sites included:

- USS JOHN C. STENNIS (CVN 74)
- USS NASSAU (LHA 4)
- USS ATLANTA (SSN 712)
- USS SAN JACINTO (CG 56)
- USS SCRANTON (SSN 656)
- Barksdale AFB, LA
- USS CORONADO (AGF 4)
- Fort Gordon, GA
- Camp Lejeune, NC
- Hanscom AFB, MA
- Joint Battle Center, VA
- Joint Demonstration and Evaluation Facility, Arlington, VA

Coalition sites were located in:

- Australia
- United Kingdom
- Canada
- NATO SHAPE Belgium
- New Zealand

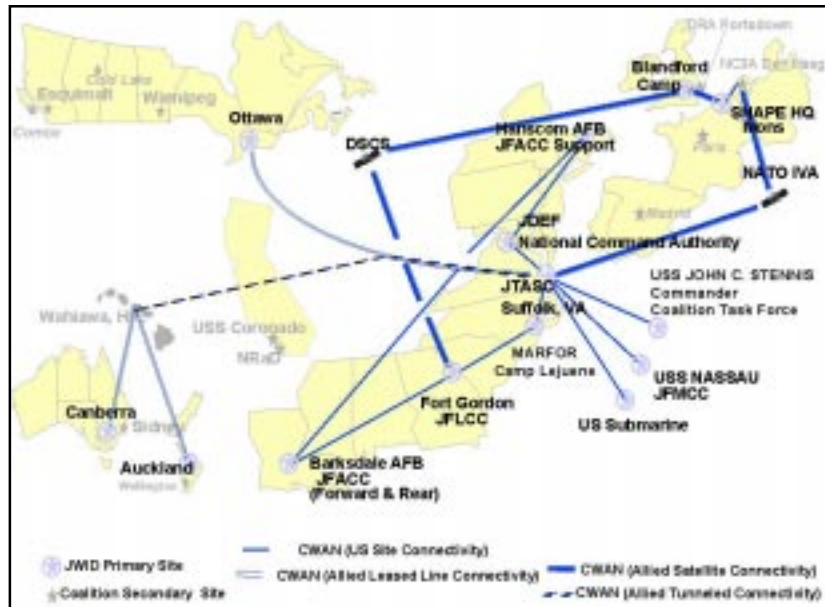


Figure 7: JWID 97

Camp Lejeune was the primary Marine Corps site for JWID 97. The Integrated Combat Operations Center (which included capabilities of GBS on-the-move), Joint Countermine C4ISR Imagery and geo-spatial support to the warrior were demonstrated at Camp Lejeune during JWID 97. The Navy will continue as the lead Service for JWID 98. JWID 98 will distribute and evaluate “Gold Nuggets” from JWID 97, and further refine several other notable initiatives from JWID 97.

**The Air Force** continues to provide strong support to JWIDs, continuing its policy of providing a numbered air force with its Joint Force Air Component Commander (JFACC) staff to operate and assess demonstrations. The Air Force’s primary objective in the 99/00 JWID cycle is to demonstrate distributed JFACC operations (forward, rear, and enroute) through all phases of conflict. Air Force demonstration sites are planned for Barksdale AFB, LA and Hanscom AFB, MA.

8<sup>th</sup> Air Force at Barksdale provided JFACC interaction during the JWID 97 scenario and conducted operator evaluation of new information technology. Electronic Systems Center’s Command Unified Battlefield Environment facility will directly support the JFACC while on the ground or enroute.

### JOINT AND SERVICE BATTLE CENTERS

The Joint Battle Center (JBC), a place where the warfighter can touch and feel new technologies year round, was established in 1996. With its initial operating capability established in the summer of 1997, the JBC provides the joint warfighter with a unique joint assessment and experimental environment. The JBC fosters rapid, near term insertion of technology and provides a primary forcing function for joint interoperability.

The JBC has formed a close relationship with the Service battle centers and laboratories through the Federated Battle Lab consortium. The purpose of the Federated Battle Lab is to promote near term C4ISR solutions to JTF operational problems and to explore new C4ISR capabilities in a collaborative experimental environment. The JBC, in conjunction with DISA/DARPA JPO, will be responsible for providing interconnected service to the primary Federated Battle Lab network. Each Service laboratory will be responsible for providing connectivity to its subordinate battle lab locations.

A Joint Staff steering group composed of the Vice Director, J2; the Vice Director, J6; and the Deputy Director, J8, provide oversight of Joint Battle Center activities.



**The Army Battle Labs** were established in 1992 for the Training and Doctrine Command to streamline its mission of identifying concepts and requirements for new doctrine, training, leader development, organizations, materiel, and soldier systems. Likewise, since warfighting is inherently joint in nature and potentially global in scope, the battle labs encourage participation from the other Services and our allies. The Army is confirming operational suitability of technologies in Advanced Warfighting Experiments (AWE). These experiments are conducted in a tactically rigorous environment to validate hypotheses regarding increases in warfighting capability. The 1st Brigade, 4th Infantry Division was the Army's Task Force XXI Experimental Force, designed to help build Army XXI. Its state-of-the art digital communications equipment, night fighting gear and doctrine have been realistically evaluated in an AWE against the National Training Center's formidable opposing force.

**The Maritime Battle Center (MBC) and the Marine Corps Warfighting Laboratory** provide the Navy and Marine Corps interface with the JBC and the other Services battle labs. The newly established MBC concluded its Fleet Battle Experiment Alpha concurrently with Hunter Warrior. The Fleet Battle Experiments will enable the Navy to co-evolve technology, organization, and doctrine. The Marine Corps Warfighting Laboratory serves as the cradle and test bed for developing enhanced operational concepts, tactics, techniques, procedures, and doctrine which will be progressively introduced into the field. This will be done in concert with new technologies. The Marine Corps Warfighting Laboratory recently completed its highly successful Hunter Warrior exercise and plans a series of Advanced Warfighting Experiments to test new operational concepts to bolster Operational Maneuver From The Sea.

**The Air Force's** six new battle labs continue the tradition of innovative thinking. A close liaison is envi-

sioned between these battle labs, the other Services, and the JBC. The Air Force is actively creating these relationships. The battle labs are small, focused, and rely on field ingenuity to identify creative operational and logistics concepts for advancing joint warfighting and placing new technology in the warfighter's hand.

The C2 Battle Lab will address ways to improve Air Force-wide command and control through new information technology and tactics, training, and procedures. One of its first projects will be to baseline a core Air Operations Center (AOC) to standardize AOC training throughout the Air Force. The Unmanned Aerial Vehicle (UAV) Battle Lab will focus on the transition from technology demonstrations to viable operational systems, notably using UAVs to possibly replace manned intelligence, surveillance, reconnaissance, and communications relay platforms. With communications and computer systems at the heart of battlespace dominance, the Information Warfare Battle Lab will explore the increasing threat to information systems by intruders of varying sophistication.

## MODELING AND SIMULATION (M&S)

We are dedicated to ensuring total interoperability for C4I systems from deployed ground forces to space-based sensor systems. To field such complex and technically diverse capabilities rapidly throughout DoD and the Services, we will use the Network Warfare Simulation (NETWARS). The vision of NETWARS is to provide a joint tool set to perform:

- Communications burden analysis
- Contingency analysis
- Emerging technology analysis



Key concepts envisioned for NETWARS include:

- A commercial simulation engine called Optimized Network Engineering Tools
- Validated Optimized Network Engineering Tools modules from users
- Multi-fidelity module integration
- A High Level Architecture based model approach
- A doctrinal based approach to developing information exchange requirements
- Validated data from users integrated into a joint database

NETWARS will seek to develop innovative software approaches and operational concepts to substantially reduce the communications analysis cycle time for a JTF scenario.

NETWARS will allow users to quickly build, simulate, and analyze a variety of specific scenarios for answering communications burden issues in the joint arena. This tool set will be robust enough to look at the complete JTF arena and simulate communication transfer and information processing and exchange requirements down to each individual network and user in a JTF. NETWARS will provide aggregate input to the evolving Joint Warfare System M&S effort.

**The Army** will use DoD compliant modeling tools and methodologies to spotlight the visualization of its information requirements. The Army is prioritizing and integrating C4I models to facilitate trade-off analysis and validation of the operational and technical architectures. The Army has provided the initial requirements for NETWARS and aggressively supports NETWARS performance objectives.

**The Navy-Marine Corps** are making aggressive full-spectrum use of simulation from individual education to the Maritime Battle Center and the Marine Corps Warfighting Laboratory. The Marine Corps maintains

ArchVision, a web accessible database which provides modeling information exchange requirements for use by the NETWARS in mapping data into its model library. Anticipated future cuts in funding for personnel, supplies, and exercise activities will place an even greater emphasis on modeling and simulation in meeting the readiness challenge.

**The Air Force** vigorously supports the joint community's modeling and simulation efforts. The Air Force's Modeling, Analysis, and Simulation Center (MASC) operates as a C4ISR M&S Center of Excellence.

It provides quality M&S analysis strategy, development, and implementation. MASC provides integration and warrior exercise support to enhance operational military readiness and effectiveness worldwide. The MASC supports the Joint Synthetic Battlespace and Battle Management C4ISR Battle Lab for seamless training, analysis, and acquisition M&S. In the analysis environment, the Air Force is

contributing to the NETWARS program for joint communications planning.

NETWARS will provide common computer based models, ensure standard model development practices, and provide proper validation and verification procedures for contingency communications planning. This use of M&S is a powerful tool for analyzing C4 system requirements for the joint warfighter.

### **SENSOR-TO-SHOOTER (STS)**

STS is a process and a capability. It is the analytical process supporting procurement and fielding decisions for integrated systems precision engagement capability. To perform precision engagement, the process must include command and control, surveillance and reconnaissance, acquisition and localization, combat identification, targeting, engagement, and battle damage assessment.

***NETWARS will allow users to quickly build, simulate, and analyze a variety of specific scenarios.***



In 1995, the Joint Staff investigated Precision Strike, concentrating on integrating ten sensors and three weapon systems with a goal of making near term recommendations to share sensor information among the Services. In 1996, the Joint Staff continued the effort to develop an integrated C4I systems architecture supporting joint operations and Joint Vision 2010. This included identifying

*Future joint operations, such as ballistic missile defense, will place greater emphasis on the need for automated C4I functions.*

communication paths required to integrate Precision Strike operations across the battlespace. The Precision Engagement Architecture Analysis Study is the next step in achieving the Secretary of Defense and the Chairman of the Joint Chiefs of Staff direction — an Integrated C4I Systems Architecture supporting joint operations.

**Army's All Source Analysis System (ASAS)** provides timely and accurate targeting information, intelligence products, and threat alerts. ASAS receives and rapidly processes large volumes of combat information and sensor reports from all sources.

The Army's **Advanced Field Artillery Tactical Data System (AFATDS)** is a multi-service C2 system of mobile, multi-functional nodes providing automated planning and execution capabilities to fire support operational facilities and remote terminals which allow commanders and personnel to monitor fire support operations and issue guidance from widely dispersed battle field locations. Both ASAS and AFATDS are parts of the Army's Battle Command System (ABCS). All five

parts of ABCS will be Common Operating Environment (COE) compliant and will exchange information via WIN and the DII.

**The Navy and Marine Corps** interface sensor systems with Battle Management, C2, and weapons for a truly integrated and interoperable sensor-to-shooter capability. Navy uses the Cooperative Engagement Capability for weapons control and exchange of unprocessed sensor data, GCCS to perform battle management, and Link-16 to network the shooters. One facet of the Marine Corps STS capabilities is the combined use of the Digital Automated Communications Terminal and Advanced Field Artillery Tactical Data System. By using these systems a forward observer can provide information to a joint shooter and place "steel-on-target" with any joint weapons system.

**The Air Force** is fielding air- and space-based assets for sensing the battlespace and providing C2 for air power. A few examples are J-STARS, AWACS, Rivet Joint, Predator, and the U2. In space, the Defense Support Program will be augmented by the Space-Based Infrared Radar System. The Air Force is integrating all sensor feeds as part of a joint format to make common global and theater operational pictures a reality. The Air Force continues to participate in Sensor-to-Shooter studies and is a driving force in standardization of the data requirements.

## DATA LINKS

Disparate data link message formats and communications media have resulted in untimely delivery of crucial battlefield information and left us with less than desired battlespace awareness. This causes significant interoperability problems among the CINCs, Services, Agencies, and allied nations. Currently, it is difficult to establish seamless information flow among diverse data link units. Future joint operations, such as ballistic missile defense, will place greater emphasis on the need for automated C4I functions. Tomorrow's battlefields will vastly increase the burden on C4I networks.

Recognizing the issue, the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD (C3I)) designated Link 16 as DoD's

primary data link. To improve the movement of information, the ASD (C3I) established the J-Series family of Tactical Data Links. These Tactical Data Links are based on TADIL-J messages and/or data elements and include Link-22 and VMF.

**The Services**, working with the Joint Staff and other DoD agencies, have developed the Joint Tactical Data Link Management Plan. This plan guides future data link development and provides the warfighter with improved battlespace situational awareness through the use of standardized tactical data links. The Joint Interoperability Test Center will test to these standards to ensure data link interoperability.

### **JOINT TACTICAL RADIO (JTR)**

In conjunction with the Joint Staff, work has begun on the JTR. This family of digital, modular, software-programmable radios, will range from a low-cost joint tactical digital radio to a higher-capability, joint multi-band, multi-mode radio with Link-16 capability. JTR will provide timely dissemination of battlespace command and control, intelligence, air navigation, and combat identification information to the warfighter at all levels. It will support varying mission requirements of the warfighters and will be capable of simultaneous networked voice, video, and data operations with low probability of intercept over multiple frequency bands.

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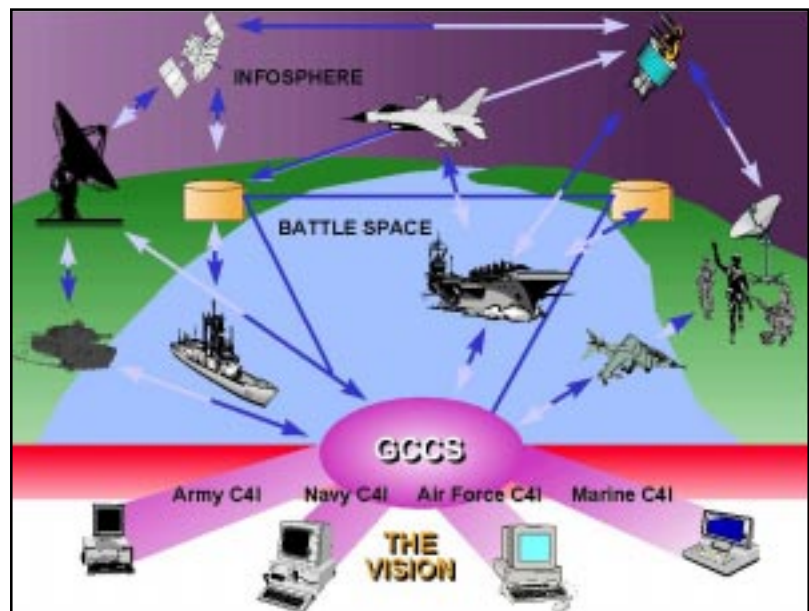
### III. MID-TERM PHASE GOALS #2 and #3

*PRODUCE MODULAR C4I SYSTEMS*

*CONSTRUCT A GLOBAL WIDE AREA NETWORK*

#### THE GLOBAL COMMAND AND CONTROL SYSTEM (GCCS)

GCCS was activated on 30 August and was the crucial success of 1996. Modular by design, its applications can be shifted among common terminals regardless of the Service owner. For example, Air Force applications can run on Marine Corps machines and the training requirements for operators are greatly reduced because of the common operating environment's similar look and feel, regardless of the host terminal. When combined with the transmission capabilities of the Defense Information Systems Network, GCCS provides a global wide area network capability. In short, GCCS provides a fused picture of the battlespace within a modern C4I system that is capable of meeting warfighter needs well into the 21<sup>st</sup> century (see Figure 8).



*Figure 8: The Global Command and Control System*

#### The Global Command and Control System - Army (GCCS-A)

GCCS-A is the Army's total implementation of GCCS. GCCS-A will become the single Army C2 system which provides all aspects of C2 support from crisis action/deployment planning to battlefield execution. The term "GCCS-A" encompasses the ABCS and the Force XXI Battle Command, Brigade, and Below. Functionality includes the Army's Strategic and Theater System, the Maneuver Control System, the Advanced Field Artillery Tactical Data System, the All-Source Analysis System, the Forward Area Air Defense Command and Control Intelligence System, and the Combat Services Support Control System. The end state is the fully interoperable, horizontal and vertical flow of relevant C2 information that is both accurate and timely into the major commands, corps and echelon below corps by fiscal year 2003. The Army will implement an integrated GCCS-A fielding schedule that maximizes technology and eliminates duplication among Army, other Service, and agency command and control systems. The goal is to implement an architecture

that provides accessibility to GCCS, GCCS-A, and the Global Command Support System functions from a single workstation. The warfighter will be able to select the appropriate functions and types of information to be "pushed forward" and "pulled backwards" when needed from a single workstation.

As part of GCCS-A, ABCS will integrate multiple fielded and developmental automated systems providing interoperability among battlefield functional areas such as maneuver, intelligence, field artillery, air defense, and logistics. The Defense Information Infrastructure Common Operating Environment is the basis for all GCCS-A software and hardware. The Army is taking the next steps in advanced interoperability. Common client-server based distributed applications are being developed to run on any subsystem. These applications will give the commanders and staffs common views of the battlefield no matter where they are located. The second major component in the Army interoperability thrust is basing information exchanges on common database structures rather than

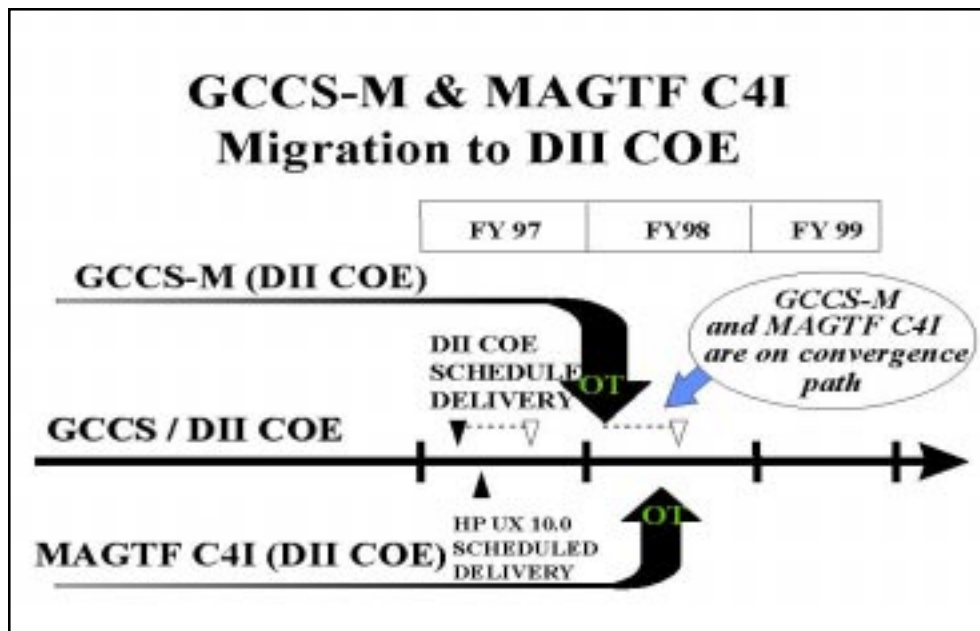


Figure 9: Navy-Marine Corps GCCS Migration

message formats. This will be accomplished through implementing an ABCS Common Data Base (ACDB).

The ACDB is based on an ABCS Transformation Data Model that is compliant with the DoD-mandated C2 Core Data Model. This database interoperability thrust will be fully compliant with the DII COE Shared Data Environment.

The Army anticipates that future small scale conflicts could make the commander of a division or even a brigade the JTF commander. The Army will employ GCCS-A components and compatible C2 systems to corps and below corps components to support future JTFs.

**The Navy-Marine Corps' Copernicus** provides reliable connectivity and interoperability with GCCS. Connectivity enables the warfighter to access timely transmission of imagery, video, voice, and data in peace, crisis, conflict, humanitarian support, and war.

The Maritime Global Command and Control System is the Navy's fielded Command and Control System. GCCS-M, (see Figure 9), has aggressively pursued an evolutionary acquisition strategy to rapidly field new C4I capabilities for afloat, ashore and tactical/mobile users. For 1998, the latest phase of the evolution includes migration to the DII COE, merging of tactical and non-tactical networks, maturation of web and personal computer technologies, and continued emphasis on acquisition streamlining.

MAGTF C4I is the overarching concept for developing and implementing the Marine Corps common hardware,

software, communications and data systems in the battlespace. It incorporates a number of systems supporting the fundamental requirements of all C2 functional areas defined in Marine Corps Doctrine Publication 6, Command and Control:

- maneuver
- air operations
- combat service support
- intelligence
- fire support
- C2 Warfare

MAGTF C4I provides the warfighter the capability to store, retrieve, receive, process and disseminate essential information in a usable format within and external to the MAGTF. This capability will support garrison and forward deployed operations including independent, naval, joint and combined operations. MAGTF C4I is the foundation for building an open system based on the DII COE.

This open system will be implemented as a set of versatile, common, low-level building blocks upon which specialized hardware and software will be added. This specialized hardware and software will satisfy the critical operational requirements of a particular C2 functional area. This will provide the warfighter a C2 system with increased interoperability, reduced development time,





increased operational capability, minimal training requirements and minimized life-cycle costs. MAGTF C4I provides Marine warfighters access to the C4I tools needed to win in any clime or place.

**The Air Force's GLOBAL ENGAGEMENT** vision fully exploits air power's inherent flexibility, speed, and precision. Global awareness, combined with real-time control and execution, will make it possible to apply measured lethality to any point on the planet. Recognizing joint operations as the norm, the Air Force is fielding the GCCS to all active, Guard, and Reserve forces. This will reach from Headquarters Air Force through the wing level providing the basis for worldwide (fixed, deployed, and airborne) access to the joint integrated C2 system. A key element to the success of this implementation is the on-going migration of Theater Battle Management Core Systems (TBMCS), space and air mobility C2 systems into the DII COE. This migration will make these critical air and space power systems available to all GCCS users. The TBMCS incorporates those Air Force battle management systems necessary to plan and fight the air war. It will be interoperable with joint service and allied units at the air operations center, wing, and unit levels.

The Air Force's non-C2 counterpart to GCCS is the Global Combat Support System (GCSS-AF). To ensure GCCS/GCSS software standardization and interoperability across all C2 and support functions, the Air Force is standing up a DII COE program office at Hanscom AFB, MA.

## DEFENSE INFORMATION SYSTEM NETWORK (DISN)

The DISN is a critical piece of the Defense Information Infrastructure providing the integrated network that meets the needs of DoD for voice, video, and data communications. DISN expands the common-user capacity of the network and provides value added services. The DISN establishes a high speed, common-user backbone which bundles individual circuits into a managed, high capacity system. Through these high speed, common-user circuits,

the DISN provides the backbone on which the warfighter's global, wide-area network will reside. The six essential DISN elements are:

- Defense Switch Network (DSN)
- Defense Red Switch Network (DRSN)
- Unclassified but Sensitive Internet Protocol Router Network (NIPRNET)
- Secret Internet Protocol Router Network (SIPRNET)
- Joint Worldwide Intelligence Communications System (JWICS)
- Video Teleconferencing (VTC)

**The Army** will rely on the DISN, as well as a robust combination of SATCOM, UAV, and fiber/copper connectivity, with opportunities for use of commercial services, to meet augmentation, surge, sustaining base infrastructure, and unique missions. In the short term, the Army will capitalize on a number of initiatives that place Force XXI and digitization efforts on a path to Joint Vision 2010. In the long term, the Army will pursue an ever greater need for range and mobility, reduced signature, increased capacities, and protection against adversary information operations. DISN will provide a critical part of each of these efforts.

**The Navy-Marine Corps** DISN implementation is accomplished through its base-level information infrastructure. The infrastructure provides the Navy-Marine Corps sustaining base connectivity to the DISN. The Navy-Marine Corps are conducting studies, technical assessments, and cost estimates to determine the improvements necessary at each base. This will result in modernization of shore-based switches, cable plants, and ship-board local area networks facilitating seamless connectivity and information flow. Upgrades are underway to evolve the current base telephone and data distribution systems to a fiber optic medium using Synchronous Optical Network and Asynchronous Transport Mode switching.

**Air Force** contributions to the Global Grid provide connectivity critical to the other Services as well as to allies and coalition partners—Information Infrastructure for the joint warrior. As the lead Service, the Air Force assists in the control, maintenance, and operation of joint satellite capabilities such as Global Broadcast Service (GBS), MILSTAR, and the Defense Satellite Communications System (DSCS). The Air Force is also leveraging high frequency (HF) communications technology and integrating it into the DII via the HF right-sizing program. The Air Force is also pursuing UAV communications relay capabilities that will further enhance inter and intratheater communications.

### **STANDARDIZED TACTICAL ENTRY POINTS (STEP)**

STEP will be the primary means to provide immediate DISN support to the warfighter. The current STEP program will upgrade 14 DSCS sites worldwide to include the procurement and installation of new equipment and the establishment of pre-position voice, data, and video services.

The primary objective of STEP is to extend DISN services into the tactical theater to provide initial connectivity between the deployed warfighter and sustaining base. DISN services will include: DSN, DRSN, JWICS, SIPRNET, NIPRNET and VTC. Today this connectivity is established via SHF (X-band) DSCS satellites. As tactical forces begin deploying tri-band satellite systems, C and Ku capability must be added to STEP sites.

The installation status for FY 96 and FY 97 are as follows:

#### **- FY96 Installation**

- Landstuhl, Germany
- MacDill AFB, Florida
- Ft Gordon, Georgia

#### **- FY 97 Installation**

- Ft Detrick, Maryland
- Croughton, England
- Northwest, Virginia
- Wahiawa, Hawaii
- Ft Bragg, North Carolina
- Ramstein, Germany

STEP gives considerable tactical advantage to deployed warfighters by providing a standard set of communications services, a flattened C4I topology, and an increased ability to plan for deployed C4I support.

### **DISN DEPLOYED STRATEGY**

The primary objective of the DISN Deployed Strategy, initiated in 1996, is three-fold:

- 1) Provide a framework to incorporate all available means of providing C4I support to the tactical theater into a single integrated support concept, designed to provide support across the entire spectrum of conflict.
- 2) Define fundamental support principles essential to the successful evolution toward the objective definition of the DISN and Joint Vision 2010.
- 3) Define C4I support requirements into pre-determined packages tailored for the six theater level elements: JTF HQ, JSOTF, and the four Service Components.

This strategy will be initiated by establishing a DISA baseline and then engaging CINCs, Services, and Agencies in refining the strategy. This strategy will be reassessed annually to ensure the synchronization of the DISN Deployed Segment and tactical C4I infrastructure as they both evolve toward JV 2010.

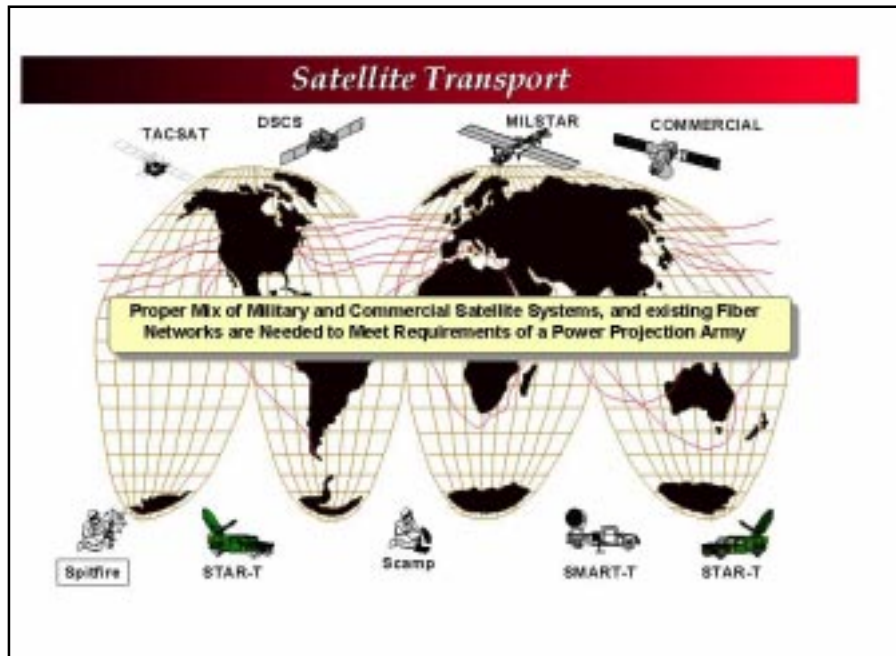


Figure 10: The DISN and Army Power Projection

The predetermined C4I support packages will improve the initial DISN responsiveness to the warfighter by minimizing the initial C4I coordination burden on the joint force and by providing tailored support on a predetermined timeline. Support packages and DISN services will be tailored for each of the six theater level force elements. The DISN voice, data, and video services in these support packages will be synchronized based upon the joint force deployment timeline. These DISN support packages provide an immediate level of support as well as the ability to increase support levels to cover the surge in requirements normally generated by the initial stages of a force build.

C4I support requirements for middle to high intensity conflicts will exceed the capacity of STEP. The role of STEP in the DISN Deployed Strategy is to buy the joint force time to plan and implement other C4I assets such as commercial satellite and fiber. These additional C4I assets will augment support between the deployed warfighter and the sustaining base.

**The Army** is digitizing the battlefield. This effort, when combined with the DISN Deployed Strategy, will assist the DISN in realizing its objective of a seamless and

interoperable battlespace. Near term highlights of Army initiatives in support of Army power projection are:

- field MILSTAR Medium and Low Data Rate SATCOM terminals
- field SHF SATCOM Tri-band terminals
- field SPITFIRE SATCOM radios
- enhancements of sustaining infrastructure
- integrate a GBS capability for the transmission to the deployed warfighter of imagery and other large data files

Long term (see Figure 10), the Army will pursue an ever greater need for range and mobility, more signature reduction, greater throughput capacities, and increased protection against electronic and information warfare through:

- Fiber gateways
- Mobile Satellite Services and tactical cellular service to the Warfighter
- Advanced EHF SATCOM
- Advanced SHF and commercial Ka wide band
- GBS Tactical Injection Points at lower echelons
- Joint Tactical Radio
- Airborne Communications Node UAV
- Joint Network Management capability to facilitate efficiency and responsiveness of C4I

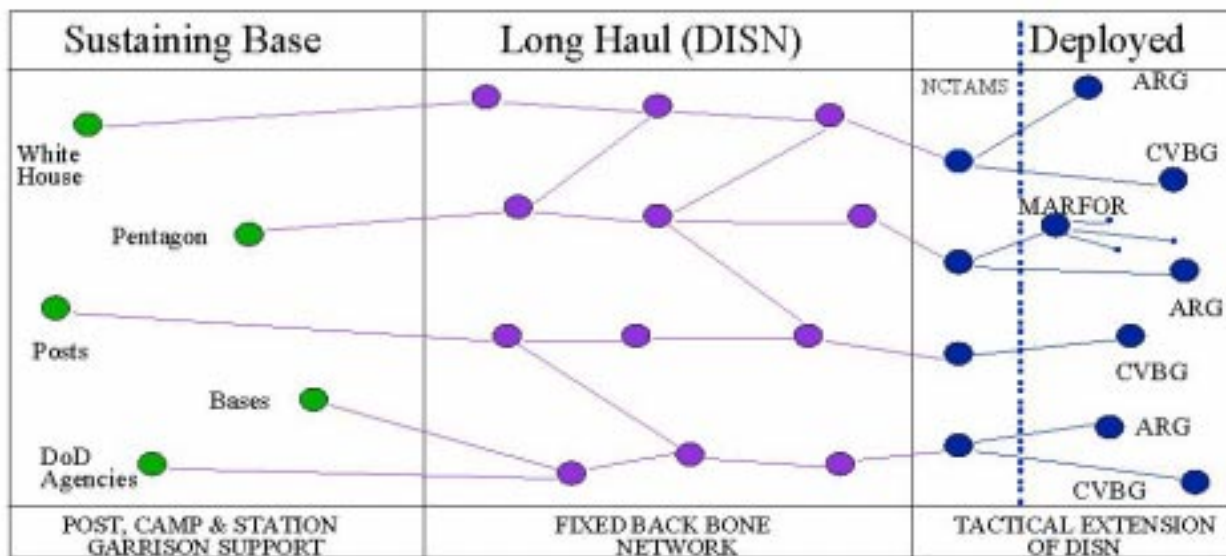


Figure 11: DISN Deployed

**The Navy and Marine Corps** approaches deployed connectivity in two ways. For the Navy, the STEP sites connect with the Navy Computer and Telecommunications Area Master Station. This provides communications to the Carrier Battle Groups, Amphibious Ready Groups, and afloat forces through the Joint Maritime Communications System (JMCMS).

Other forces are linked in a similar manner by the JMCMS. JMCMS is an aggressive strategy to field high capacity radio communication systems and to deploy network management and control capabilities to meet ever expanding communications throughput requirements. The Information Technology-21 initiative is an acceleration of this implementation.

The Marine Corps' DISN deployed portion, (see Figure 11), will connect directly or via a naval vessel to the STEP site, depending on mission. For Naval expeditionary operations, Operational Maneuver From The Sea to the objective, the Marine Corps will rely on sea-based assets.

For missions of longer duration, the Marine Corps links to the STEP using various long haul transmission systems. The transmission systems connect to a Digital Technical Control which provides quality assurance. Further dissemination of information to the warfighter will be

accomplished using the Marine Corps' Tactical Data Network. The Marine Corps is working closely with the Army's Digitization of the Battlefield effort in order to maximize interoperability and cost savings.

**The Air Force**, continuing its tradition of strong team play in joint operations, leverages the Global Grid as a vital warfighting tool by integrating its "Information Infrastructure for the Airman" concept into the DISN Deployed Strategy. Toward this end, the Air Force is modernizing its fixed, deployed, and airborne infrastructures. Examples that illustrate the Air Force commitment to maintaining a swift pace in technology insertion, especially in critical deployed systems are:

- Combat Information Transport System
- Theater Deployable Communications
- Airborne Communications Support
- Air Force Network Control Centers (fixed and deployable)

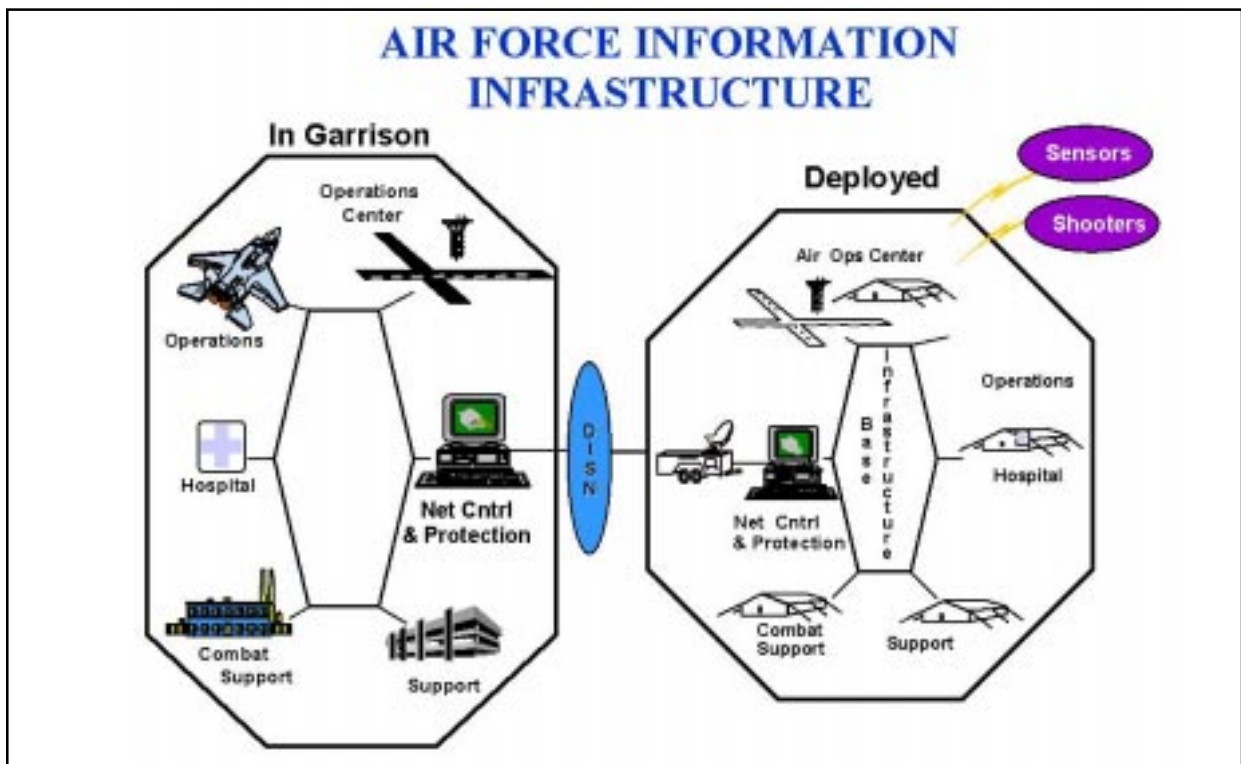


Figure 12: Air Force Information Infrastructure

As depicted in Figure 12, the Air Force's deployable infrastructure will mirror its garrison version. The C4I warrior will be linked seamlessly into the global infosphere by integration of this infrastructure with air and space based C2 and sensor assets, such as GBS, Milstar, DSCS, UHF Follow-on satellites, and UAV, Rivet Joint, J-STARS, and AWACS aerial platforms. Where the mission dictates, these programs field modular, scaleable, small-footprint, interoperable, high capacity, usable, and reliable systems. These systems will place fewer demands on our airlift resources thereby freeing assets for other elements of the joint team.

This results in enhanced capabilities for reaching deployed areas sooner, with tailored packages that improve mission responsiveness in theater operations.



### IV. OBJECTIVE PHASE: INFORMATION SUPERIORITY

The Objective goal of the *C4I for the Warrior* vision is Information Superiority. Joint Vision 2010 describes Information Superiority as “the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary’s ability to do the same (see Figure 13). It will incorporate both offensive and defensive components of information operations.



*Figure 13: The Lens of Information Superiority*

### NETWORK CENTRIC WARFARE

Crucial to information superiority is the emerging concept of Network Centric Warfare. Network Centric Warfare focuses on the information flow among sensors, command and control assets, and engagement platforms, instead of focusing on the platforms themselves. It seeks to increase the velocity of information flow among our integrated systems so that we achieve and exploit

battlespace awareness faster than our adversaries. Information Superiority allows our commanders to employ widely dispersed joint forces in decisive operations, engage and reengage with the appropriate force, protect the force throughout the battlespace, and conduct tailored logistical support.



The ability to incorporate the right tools and streamline the systems integration and fielding process is vital to Information Superiority. As the lens that focuses individual fighting capabilities of Joint Vision 2010, Information Superiority is critical to achieving the Chairman's vision of how we will fight in the new millennium.

**Digitization will enable the Army** of the 21st Century to achieve Information Superiority. It will provide decision makers, shooters, and support organizations the information each needs to make the vital decisions necessary to win campaigns.

**For the Navy and Marine Corps** the most important facet of Information Superiority, whether in support operations or in combat, is time. It's all about "time." The Navy and Marine Corps in their traditional forward presence role are well positioned to take advantage of the time factor. Forward presence allows the Navy-Marine Corps to close timelines, change critical initial conditions, foreclose enemy options, and stop something before it starts. In the briefest terms, that is why information systems and processes are so important to us as a nation. Properly used, Information Superiority enables a phenomenon called "speed of command." Speed of command involves a well conceived and precisely placed early effort which produces extraordinarily high rates of change, locks out enemy options and locks in our success. This is not about technology. It's about *how you use technology!*

**The Air Force** views Information Superiority as an indispensable competency required to achieve the National Strategy and reach the promise of Joint Vision 2010, HORIZON, and C4I/TW. A robust, high capacity Global Grid is absolutely required to meet the Air Force's goal to be able to find, fix, track, and target any target worldwide in near real-time.

During the C4I/TW Objective time frame, we will see continued efforts to provide infrastructure that can support 100 mbps bandwidth throughout a fixed or deployed site. DISN bandwidth to deployed sites will increase at least one order of magnitude to support the bandwidth intensive needs of our future customers. Information Dissemination management will become a key process to prevent

customers from suffering an information overload. Joint network management capabilities will be a necessity in a deployed tactical environment to ensure deployed customers are provided the appropriate level of reliable service. Just as Information Superiority is the focus lens for Joint Vision 2010, Information Superiority is the enabling core competency for all other Air Force capabilities.

## CONCLUSION

1996 and 1997 DEMONSTRATED SOLID PROGRESS TOWARDS THE VISION OF C4I/TW AND JOINT VISION 2010. Progress in accomplishing the goals of the Mid Term phase was tremendous due to the focus provided by the Services' complementary visions. These visions provided an additional level of granularity to *C4I for the Warrior* and guided the Service's interoperability efforts. Each Service, agency, and combatant commander completed a myriad of actions, which brought us closer to accomplishing the Mid Term goals. The consistent focus provided by *C4I for the Warrior*, the Army *Enterprise*, the Navy-Marine Corps' *Copernicus*, and the Air Force's *Horizon* will continue to bring us closer to seamless C4I. Undoubtedly, this same commitment will see us through the final objective of the vision - Information Superiority.

**2010 IS ONLY TWELVE YEARS AWAY. WE MUST SET GOALS AND MEET OR EXCEED THEM!  
1998 EFFORTS MUST INCLUDE:**

- Initial NETWARS capability
- Additional resources for bigger C4 pipes
- Progress towards joint network management
- Emergence of the Global Combat Support System: refinement of GCCS
- Rapid acquisition of information technology

**C4IFTW POINTS OF CONTACT**

Joint Staff	J-6/J6I	Comm (703) 614-7787	DSN224-7787
Army	ODISC4/SAIS	Comm (703) 697-7818	DSN227-7818
Navy	N6/N6C	Comm (703) 601-1297	DSN 329-1297
Marine Corps	AC/S C4I (CS)	Comm (703) 614-3080	DSN224-3080
Air Force	AFCIC/XPP	Comm (703) 695-4782	DSN225-4782



## GLOSSARY

ABCS	Army Battle Command System
ACDB	ABCS Common Data Base
ACN/UAV	Airborne Communications Node/Unmanned Aerial Vehicle
ACTD	Advance Concept Technology Demonstration
AFB	Air Force Base
AKMS	Army Key Management System
ANSOC	Army Network and Systems Operations Center
AOC	Air Operations Center
ARG	Amphibious Ready Group
ARP	Army Research Plan
ASAS	All Source Analysis System
ASC2A	Air and Space Command and Control Agency
ASD (C3I)	Assistant Secretary of Defense for Command, Control, Communications and Intelligence
AWACS	Airborne Warning and Control System
BDE	Brigade
BVTC	Battlefield Video Telecommunications Conferencing
C2	Command and Control
C2CDM	C2 Core Data Model
C4	Command, Control, Communications, and Computers
C4I	C4 and Intelligence
C4IFTW	<i>C4I For The Warrior</i>
C4ISR	C4I Surveillance, and Reconnaissance
CINC	Commander In Chief
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
COE	Common Operating Environment
CUITN	Common User Installation Transport Network
CVBG	Carrier Battle Group
DARPA JPO	Defense Advanced Research Project Agency Joint Project Office
DII COE	DII Common Operating Environment
DII	Defense Information Infrastructure
DISA	Defense Information System Agency
DISN	Defense Information System Network
DoD	Department of Defense
DRSN	Defense Red Switch Network
DSCS	Defense Satellite Communications System
DSN	Defense Switch Network

## GLOSSARY

EHF	Extremely High Frequency
EMUT	Enhanced Manpack UHF Terminal
EPLR	Enhanced Position Location Reporting System
FDR	Future Digital Radio
FSEN	Future Small Extension Node (Switch)
GBS	Global Broadcast Service
GCCS-A	Global Command and Control System - Army
GCCS	Global Command and Control System
GCCS-M	Global Command and Control System - Maritime
GCSS	Global Combat Support System
GCSS-AF	Global Combat Support System - Air Force
HAE	High Altitude Enhanced
HCLOS	High Capacity Line of Sight (Radio)
HF	High Frequency
INC	Internet Controller
INFOSEC	Information Security
IO	Information Operations
IP	Internet Protocol
ISM	Installation Support Module
ISYSCON	Integrated Systems Control
JBC	Joint Battle Center
JCPMS	Joint Task Force Communications Planning and Management System
JFACC	Joint Force Air Component Commander
JMCOMS	Joint Maritime Communications System
J-STARS	Joint Surveillance and Target Attack Radar System
JTA	Joint Technical Architecture
JTR	Joint Tactical Radio
JTF	Joint Task Force
JTIDS	Joint Tactical Information Distribution System
JWICS	Joint Worldwide Intelligence Communications System
JWID	Joint Warrior Interoperability Demonstrations
M&S	Modeling and Simulation
MAGTF	Marine Air-Ground Task Force
MARFOR	Marine Forces
MASC	Modeling, Analysis, and Simulation Center
MBC	Maritime Battle Center
MILSTAR	Military Strategic & Tactical Relay System





## GLOSSARY

MISSI	Multi-Level Information Systems Security Initiative
MLS	Multilevel Security
MTMP	Major Army Command Telephone Modernization Program
NATO	North Atlantic Treaty Organization
NCTAMS	Naval Computer and Telecommunications Area Master Stations
NETWARS	Network Warfare Simulation
NIPRNET	Unclassified but Sensitive Internet Protocol Router Network
OPLAN	Operations Plan
OSCAR	Outside Cable Rehabilitation
PCS	Personal Communication Services
PPC4I	Power Projection Command, Control, Communications, Computers and Intelligence
SATCOM	Satellite Communications
SCAMP	Several Channel Anti-Jam Man Portable
SHF	Super High Frequency
SINGARS	Single Channel Ground and Airborne Radio System
SIPRNET	Secret Internet Protocol Router Network
SMART-T	Secure Mobile Anti-Jam Reliable Terminal Tactical
STAMIS	Standard Army Management Information System
STAR-T	SHF Tri-band Advanced Range Extension Terminal
STEP	Standardized Tactical Entry Point
STS	Sensor-to-Shooter
TACSAT	Tactical Satellite
TADIL-J	Tactical Data Information Link J (Link 16)
TBMCS	Theater Battle Management Core Systems
TDL	Tactical Data Link
TMG	Tactical Multinet Gateway
TTP	Tactics, Training, and Procedures
UAV	Unmanned Aerial Vehicle
UHF	Ultra High Frequency
VMF	Variable Message Format
VTC	Video Teleconferencing
WIN	Warfighter Information Network